UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,116	06/26/2003	Michael J. Berman	03-0538	3693

24319 7590 04/28/2005

LSI LOGIC CORPORATION
1621 BARBER LANE
MS: D-106
MILPITAS, CA 95035

EXAMINER	
NGUYEN, GEORGE BINH MINH	
ART UNIT	**PAPER NUMBER**
3723	

DATE MAILED: 04/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/607,116	BERMAN, MICHAEL J.	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6 and 7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Receipt is acknowledged of Applicant's RCE filed on March 23, 2005.

Claims 1-4 and 6-7 are presented for examination.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 23, 2005 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4 and 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Drill et al. '6,347,979 in view of Tanaka'5,902,173.

With reference to Figure 6B, col. 7, line 39 to col. 8, line 67, Drill discloses the claimed invention including: a) a wear ring 312; b) at least one inlet 611; c) arm 306 including a manifold adapted to provide slurry only to the slurry dispense holes 611. It is noted that a manifold is defined in the Webster Dictionary as a pipe or channel to connect one inlet to a plurality of outlets; and d) a plurality of outlets 411. However, Drill does not disclose

at least one channel located inside the wear ring in communication with the plurality of outlets 411.

texture of the surface of the polishing pad **302** and is transported under the surface of the wafer **311** as both the polishing pad **302** and the wafer **311** rotate. Consumed slurry and polishing by-products, in a similar manner, also adhere to the surface of the polishing pad **302** and are transported away from the surface of the wafer **311**. As the polishing process continues, fresh slurry is continually dispensed onto the polishing pad by dispensing ring **312**. The polishing process continues until the wafer **311** is sufficiently planarized and removed from the polishing pad **302**.

By dispensing slurry directly into contact with wafer **311**, dispensing ring **312** reduces the waste of slurry in the CMP process of CMP machine **300**. The slurry is "targeted" directly onto wafer **311**. In so doing, dispensing ring **312** renders the CMP process more cost effective by using slurry in the most efficient manner. Dispensing ring **312** of the present invention is shown in more detail in FIGS. **4A** and **4B** below.

FIG. **4A** and FIG. **4B** show a down view of dispensing ring **312** and a side view of dispensing ring **312** respectively. As depicted in FIGS. **4A** and **4B**, dispensing ring **312** of the present embodiment has a diameter **403**, a lower surface **406** substantially parallel to the plane defined by the diameter **403**, and an inner radius surface **402** substantially orthogonal to the plane defined by the diameter **403**. The inner radius surface **402** is adapted to confine the semiconductor wafer (e.g., wafer **311**). An outer radius surface **401** is located opposite the inner radius surface **402**. An upper surface **405** is located opposite the lower surface **406**.

In the present embodiment, a plurality of slurry dispense holes **411** extend through the dispensing ring **312** from the upper surface **405** to the lower surface **406**, wherein the slurry dispense holes are adapted to flow slurry from the CMP machine **300** to the lower surface **406** so that the slurry contacts the wafer **311** confined within the inner radius surface **402**. As described above, this provides for the more efficient utilization of slurry in the CMP process and minimizes the amount of wasted slurry.

FIG. **5** shows a down view of dispensing ring **312** and wafer **311** on polishing pad **302** as wafer **311** is being polished and dispensing ring **312** is dispensing slurry. As described above, slurry is flowed into contact with wafer **311** via the slurry dispense holes **411**. This provides a more targeted delivery of slurry to wafer **311** and eliminates the need for coating the entire surface of pad **302** with slurry.

With reference now to FIG. **6A** and FIG. **6B**, FIG. **6A** shows a side cut away view of wafer **311** and dispensing ring **312**, as wafer **311** and dispensing ring **312** are positioned on top of pad **302**. FIG. **6A** also shows an area **600**, which is shown in greater detail in FIG. **6B**. As depicted in FIG. **6B**, area **600** shows wafer **311** receiving a downward directed force from the carrier (not shown). Wafer **311** is confined in place on pad **302** by inner radius surface **402**. Dispensing ring **312** receives a downward force from arm **306** and is pressed into the resilient surface of pad **302**.

In the present embodiment, arm **306** includes a plurality of slurry passages (e.g., passage **601**) which align with each of the slurry dispense holes **411**. CMP machine **300** pumps slurry though the slurry passages **601**, through the slurry dispense holes **411**, onto pad **302**, and into contact with wafer **311**.

FIG. **6B** depicts the case where the carrier ring used in a CMP process has a negative amount of protrusion into the surface of polishing pad **302** with respect to the surface of wafer **311**. As shown in FIG. **6B**, the lower surface of dispensing ring **312** is pressed further into the resilient surface of polishing pad **302** than the lower surface of wafer **311**. This negative protrusion amount is used to reduce non-uniformity were the edges of wafer **311** tend to be polished away faster than the center of wafer **311**. Many CMP machines used this negative protrusion crucial to decrease the relative force exerted by polishing pad **302** against the edges of wafer **311** in comparison to the force exerted against the center of wafer **311**. This counteracts the fact that the edges of wafer **311** have a greater angular velocity (e.g., due to the rotation of wafer **311** by arm **306**) on polishing pad **302** than the center of wafer **311**. In prior art CMP machines the negative protrusion interfered with the flow of slurry to the surface of wafer **311**. In contrast, the dispensing ring **312** of the present invention ensures slurry is delivered uniformly to wafer **311** regardless of any amount of negative protrusion.

It should be noted that slurry can be pumped through dispensing ring **312** in a symmetric or asymmetric manner. In the case where slurry is pumped through dispensing ring **312** in a symmetric manner, each of the slurry dispense holes **411** receives an amount of slurry from a corresponding slurry passage **601** in arm **306**. Each of the slurry passages **601** delivers approximately the same amount of slurry to its respective hole of dispense holes **411**. In the case where slurry is pumped through dispensing ring **312** in an asymmetric manner, only the slurry dispense holes **411** in a certain region of the dispensing ring **312** receive slurry as the wafer **311** is being polished.

For example, as polishing pad **302** rotates beneath wafer **311**, slurry can be pumped to the slurry dispense holes **411** on the "leading-edge" of the dispensing ring **312** with respect to polishing pad **302**. This provides the advantage of injecting slurry under the leading-edge of wafer **311** as wafer **311** slides across the surface of polishing pad **302**. The slurry subsequently contacts the full surface of wafer **311** with even less waste. This is depicted in FIG. **7** below.

Referring now to FIG. **7**, a detail view of dispensing ring **312**, slurry dispense holes **411**, and a dispensing region **701** is shown. As depicted in FIG. **7**, the surface of polishing pad **302** slides underneath dispensing ring **312** from the right side of FIG. **7** to left side of FIG. **7**. As described above, in the case of asymmetric slurry injection, slurry is dispensed through the dispense holes of region **701** only. In leading edge asymmetric slurry injection (hereafter referred to simply as leading-edge slurry injection), region **701** covers the leading-edge of dispense ring **312** as dispense ring **312** slides across the surface of polishing pad **302**.

It should be noted that dispensing ring **312** rotates as it slides across the surface of polishing pad **302**. Accordingly, new slurry dispense holes are constantly being rotated into dispensing region **701** (wherein region **701** remains fixed on the leading-edge of dispensing ring **312**) and slurry dispense holes **411** are constantly being rotated out of dispensing region **701**. These holes only receive slurry from arm **306** while they are within dispensing region **701**. In this manner, fresh slurry is constantly injected underneath the leading-edge of wafer **311** as wafer **311** rotates with respect to polishing pad **302** and as wafer **311** slides across the surface of polishing pad **302**.

It should be noted that there are several means of implementing a dispensing region within dispensing ring **312**. For example, arm **306** can include a manifold adapted to provide slurry only to those slurry dispense holes **411** which are in the correct region (e.g. within dispensing region **701**). This manifold remains fixed even though dispensing ring **312** and wafer **311** are rotated with respect to polishing pad **302**. Leading-edge slurry injection is graphically depicted in FIG. **8** below.

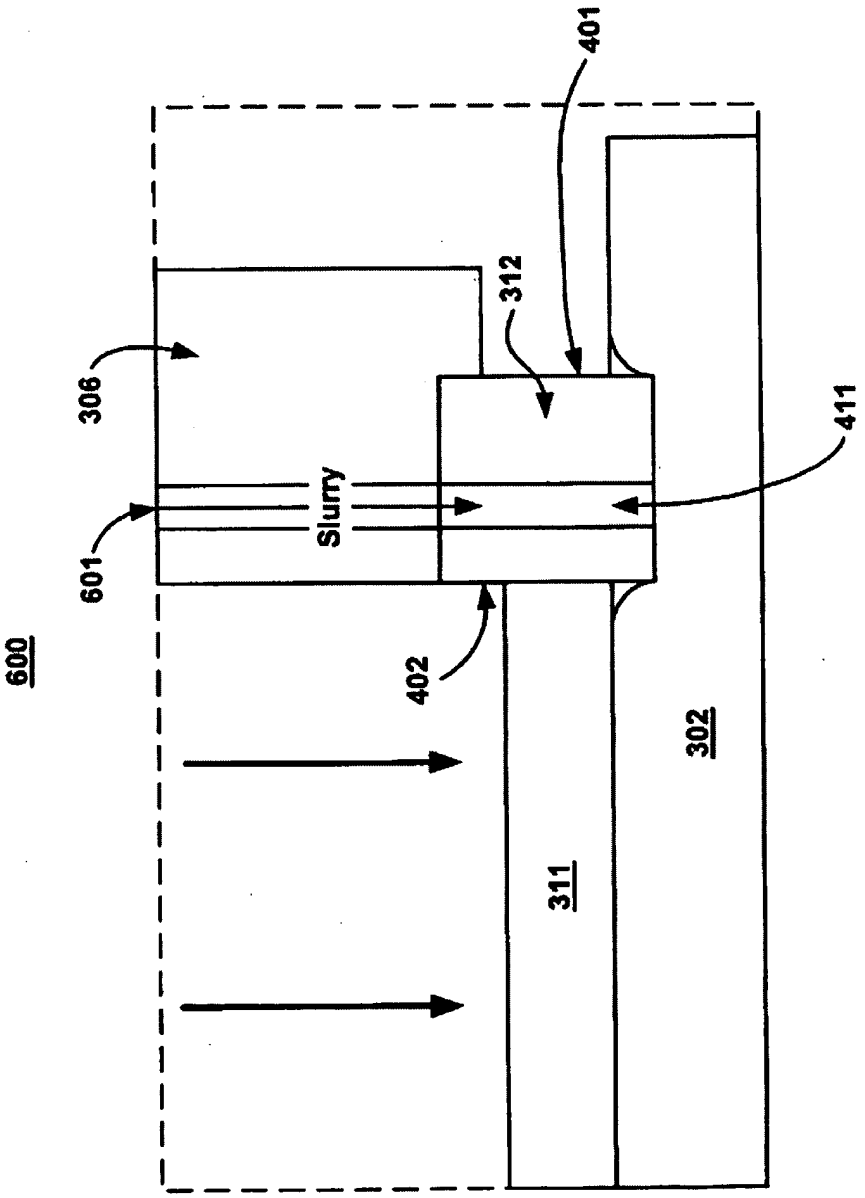
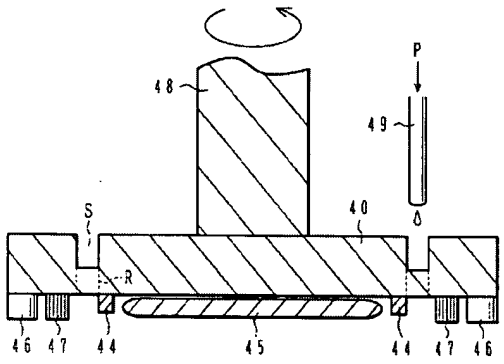


FIG. 6B

With reference to Figure 22, col. 7, lines 43-59, Tanaka teaches that it is known to have utilized at least one channel S in communication with a number of holes R so that polishing agent P can be supplied therefore from a dispensing nozzle 49 to the wafer 45 via the groove S and holes R. The advantage is to provide a uniform slurry supply to the holes.



The feature of the tool/wafer holder **40** shown in FIG. **23** is that a tool holder unit **40***b* with a lapping tool **46** is rotated independently from a wafer holder unit **40***a* with a brush **47**. Specifically, the lapping tool **46** is adhered to the bottom of the tool holder unit **40***b* which is mounted covering the wafer holder **40***b*, whereas the brush **47** is adhered to the bottom of the wafer holder unit **40***a*. The tool holder unit **40***b* is rotated by a rotary shaft **48***b* disposed coaxially with, and outside of, a rotary shaft **48***a* for rotating the wafer holder unit **40***a*. A groove Sa is formed in the tool holder unit **40***b*, and a groove S corresponding in position to the groove Sa is formed in the wafer holder unit **40***a*. A number of holes R are formed in the groove S, opening to the bottom surface of the wafer holding tool **40***a*. Polishing agent **P** can be supplied therefore from a dispensing nozzle **49** to the wafer **45** via the grooves Sa and S and holes R.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the wear ring 312 of Drill polishing apparatus with one common channel S connected to a plurality of outlets hole R to provide slurry to the polishing pad as taught by Tanaka in order to provide a uniform slurry supply to all outlet holes.

Regarding to the method claims, the steps would have been obvious by the functions of the prior art apparatus.

Response to Arguments

4. Applicant's arguments filed March 23, 2005 have been fully considered but they are not persuasive. Regarding to Applicant's argument that neither Drill nor Tanaka

teaches a channel inside a wear ring, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). As indicated in the above rejection, it is a well-known to have employed a channel or manifold to connect one inlet to a plurality of outlets for controlling purposes. Thus, the above 103 rejection deems to be proper because the motivation for the combination is implicitly stated in Tanaka. Supposedly, Drill or Tanaka discloses a channel inside the wear ring, and then the rejection would have been made under 102.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 571-272-4491. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 571-272-4485. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE NGUYEN
PRIMARY EXAMINER

George Nguyen
Primary Examiner
Art Unit 3723

GN – April 26, 2005